In Situ Oxygen Generation from CO2 under Benign Conditions

Completed Technology Project (2016 - 2018)

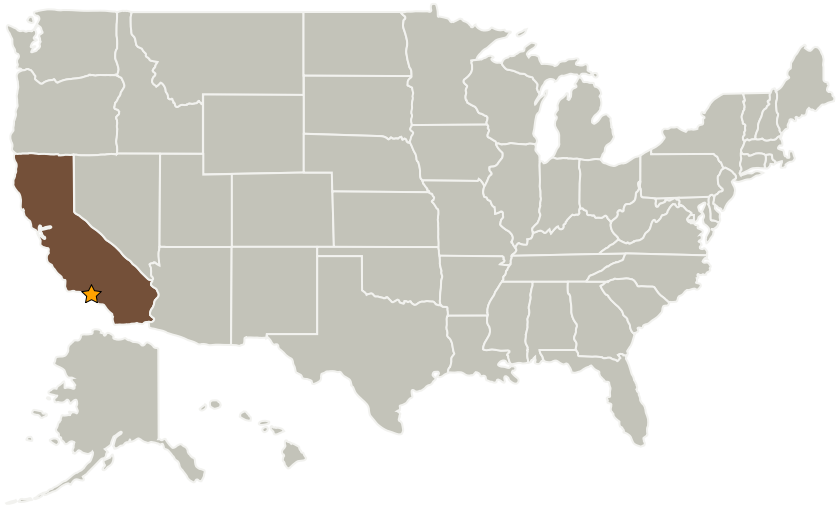
Project Introduction

Pursue molecular- and nano-based catalysts to attach and activate CO2 molecules to release dioxygen (O2) after the application of external energy. Our approach seeks to prove that molecular catalysis with electrochemistry is more efficient than high temperature to generate O2.

Anticipated Benefits

Generating O2 from CO2 under benign conditions could provide next generation technology for in situ resource utilization in potential manned missions on Mars, ISS, and other planetary environments. The system in this work could potentially be leveraged to produce fuels, fertilizers, or other species for ISRU applications. The CO2 conversion to O2 technology could provide an effective approach to recycle CO2 from the terrestrial atmosphere and offers great promise for climate control. The system shows promise and is currently at TRL 2.

Primary U.S. Work Locations and Key Partners



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Center Innovation Fund: JPL CIF

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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
California Institute of Technology(CalTech)	Supporting Organization	Academia	Pasadena, California

Primary U.S. Work Locations
California

Project Transitions

October 2016: Project Start

September 2018: Closed out

Closeout Summary: The approach taken is to use a two-step process. First pro duce water from CO2 then produce oygen from water. Step 1 water production was confirmed by proton nuclear magnetic resonance (NMR) and Karl Fischer m easurements. Yield was ~100% with 1 molecule of water produced for every CO 2 molecule consumed with a projected production rate: 30 nmole/s \xe0 90 g H 2O/hour for 1 g catalyst (a rough estimate based on NMR spectrum assuming 2 0 ug catalyst used). Step 2, oxygen from water was also successful with 100% c onfersion. These are lab experiments under idealized conditions, but the results are very promising.

Project Website:

https://www.nasa.gov/directorates/spacetech/innovation_fund/index.html#.VC

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Center / Facility:
Jet Propulsion Laboratory (JPL)

Responsible Program:
Center Innovation Fund: JPL CIF

Project Management

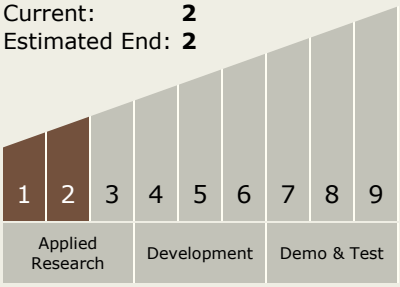
Program Director:
Michael R Lapointe

Program Manager:
Fred Y Hadaegh

Principal Investigator:
Chaoyin Zhou

Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



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Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.1 Atmosphere Revitalization

Target Destinations

The Moon, Mars, Earth